THE CLAIMS

I Claim:

1. An apparatus for removing particulate matter and pollutants from a gas stream comprising, a duct having a gas inlet first end connected to receive a gas stream containing pollutant particles, said duct defining a straight passageway between said at a first end and a second end that connects to vent particulates into a particulate removal means, said duct having a length and has a sorbent material injector means fitted into a duct side at a sorbent introduction site, with said sorbent material injector means having a nozzle end located within the duct that is to pass particles of a sorbent material into, and counter-current to, a flue gas flow, passing through said duct that contains pollutant particles, providing mixed and compacted sorbent material and pollutant particles; a moisture sensor means installed in said duct downstream from said injector means nozzle end to read moisture content of the gas stream containing said mixed and compacted sorbent material and pollutant particles; moisture injector means fitted into said duct downstream from said moisture sensor means and spaced from twenty to thirty feet from said sorbent material injector means nozzle end for injecting water, as a mist, into said gas stream containing said mixed and compacted sorbent material and pollutant particles, which said moisture injector means is connected to a source of water and is operated in response to a sensing, by said moisture sensor means, of a requirement to moisturize said gas stream containing said mixed and compacted sorbent material and pollutant particles to provide a moisture content thereto that is a percentage of from eighteen to twenty percent of saturation, and which said moisture is injected into said mixed and compacted sorbent material and pollutant particles prior to its passage into a removal means; removal means for removing said mixed and compacted sorbent material and pollutant particles.

2. The apparatus as recited in Claim 1, wherein the moisture injector means that is located in the duct, twenty to thirty feet downstream from the sorbent material delivery means, is connected to operate on command from the moisture sensor means, to pass a moisture flow into said duct, to provide moisture to said mixed and compacted sorbent material and pollutant particles, downstream from said sorbent injector means, to raise the moisture content so as to promote reaction of said mixed and compacted sorbent material and pollutant particles that pass into the removal means.

3. An apparatus as recited in Claim 2, wherein the moisture injector meas includes a nozzle that provides water, as a fine water mist, into said mixed and compacted sorbent material and pollutant particles.

4. An apparatus as recited in Claim 3, wherein moisture is passed through a nozzle end of the moisture injector means as a fine water mist into the mixed and compacted sorbent material and pollutant particles to provide a moisture content of from eighteen to twenty percent of a saturation humidity.

5. An apparatus as recited in Claim 4, wherein the moisture injector means includes a nozzle end arranged to inject a mist of water droplets that have diameters of from ten to fifteen microns.

6. An apparatus as recited in Claim 1, wherein said removal means is a bag house system connected by a vent to the second end of the duct passageway, and said bag house includes a plurality of bags having open ends therethrough the mixed and compacted sorbent material and pollutant particles are directed, and each bag is formed from a bag material having pores that each function as a site for receiving the mixed and compacted sorbent material and pollutant particles.

7. An apparatus as recited in Claim 1, wherein sorbent material is selected for its reaction

capability with particulate matter of the flue gas stream and is ground to a fine consistency of from one hundred fifty to three hundred fifty mesh.

8. An apparatus as recited in Claim 1, wherein said sorbent material is a hydrated lime, quick lime or limestone..

9. An apparatus as recited in Claim 1, further including an initial sensor means for measuring gas flow pressure and temperature that is located in the duct upstream from the sorbent material injector means to measure the entering flue gas stream temperature, pressure and moisture content as are present in said flue gas stream prior to introduction of sorbent material therein.

10. An apparatus as recited in Claim 9, wherein the initial sensor means is connected to control operation of the sorbent material injector means to increase or decrease sorbent material volume of flow and pressure, and to control operation of a valve that is opened on command of said initial sensor means to pass a moisture flow into said sorbent material passing into said sorbent material injector means.

11. An apparatus as recited in Claim 1, further including at least one static fin or plate, secured along a coupling edge thereof to a duct inner wall, extending from said duct inner wall toward said duct longitudinal center axis, and slanting with the direction of flue gas steam flow at an angle from said duct inner wall that is less than ninety degrees.

12. An apparatus as recited in Claim 1, wherein the sorbent material injector means includes a straight tube that is fitted through and secured at its outer surface to the duct so as to form an angle of from thirty to sixty degrees to the duct interior wall, sloping into the gas stream flow.

13. A method for the remediation of particulate material and gases from a flue gas stream consisting of injecting a flow of sorbent material particles as a counter-current flow to the flue gas

stream into a flue gas stream that contains pollutant materials and gases creating turbulence and mixing and compacting sorbent material and pollutant particles; measuring the moisture content of the flow of compacted sorbent material and pollutant particles; and, as needed, adding water as a mist to said flow of said mixed and compacted particles so as to raise the moisture content of said flue gas stream to a moisture content as is appropriate for a removal system whereto said flue gas stream is directed that is selected to remove the compacted particulates from the flue gas stream.

14. A method as recited in Claim 13, wherein lime is ground to a particle size of from fifty (50) to three hundred fifty (350) mesh as the selected sorbent material.

15. A method as recited in Claim 13, wherein the sorbent material particles are injected into the flue gas flow at an angle of between forty-five (45) and ninety (90) degrees counter-current to the flue gas stream direction of flow.

16. A method as recited in Claim 13, wherein the sorbent material particles are injected through a nozzle at a pressure that is selected to provide particle mixing and compaction while allowing the combined flue gas stream and sorbent material flow to continue to a particulate removal system.

17. A method as recited in Claim 16, wherein the moisture content of the combined flows is sensed before passage into the particulate removal system and moisture is added to the combined flue gas stream and sorbent material particles, as a fine spray, and in an amount, as needed, to raise the flue gas stream a moisture content so as to provide a reaction and separation of the compacted particulates in the selected particulate removal system.

18. A method as recited in Claim 17, wherein moisture is added, as needed, to the combined flue gas stream as a fine or atomized mist having droplets of from ten (10) to fifteen (15) microns.

19. A method as recited in Claim 18, wherein where the selected particulate removal system is a bag house system, and the moisture as is added to the combined flue gas stream raises the moisture content thereof to between eighteen (18) and twenty (20) percent.

20. A method as recited in Claim 19, where the bag house utilizes polyester bags.

21. A method as recited in Claim 13, further including, prior to injection of the sorbent material particles into the flue gas flow, sensing the flue gas temperature and moisture content and, as needed, increasing the pressure and/or volume of the sorbent material that are injected counter-current into the flue gas stream; and, as needed, adding water to said flue gas flow.

22. A method as recited in Claim 13, further including interposing one or more fins or plates into the combined sorbent material and flue gas stream to promote additional turbulence and particle compaction.